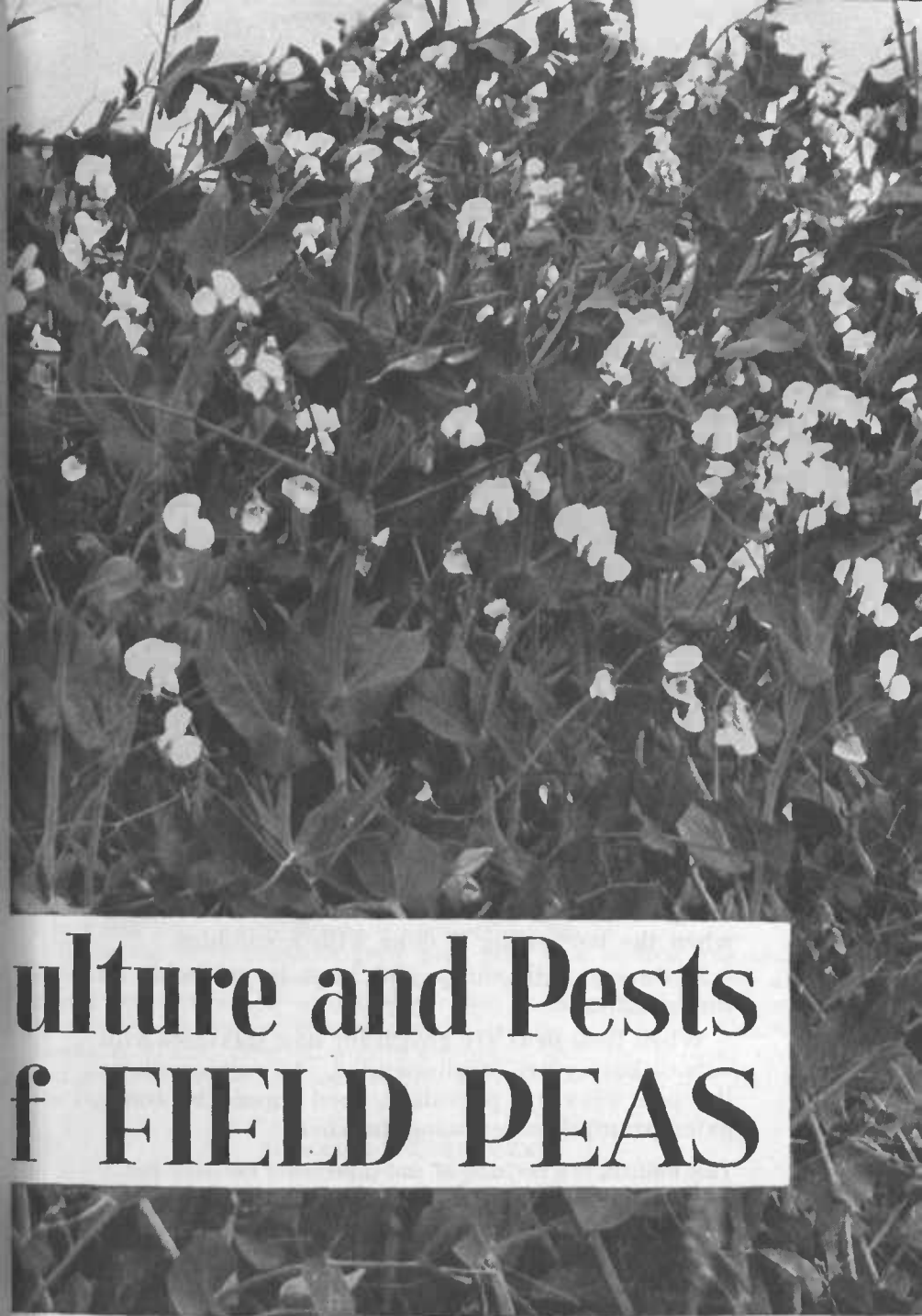

ulture and Pests f FIELD PEAS

FARMERS' BULLETIN No.1803
U.S. DEPARTMENT OF AGRICULTURE

FIELD PEAS can be grown throughout the greater part of the United States. They are used extensively in the Cotton Belt of the Southeastern States as a winter cover crop and in the Pacific Northwest as a seed crop. They are also used for hay, pasturage, and silage. A cool season is essential for their best development.

Cultural requirements are not exacting, but in practically all regions inoculation is essential or beneficial.

Clay loams of limestone formation or neutral or low-acidity soils are best suited to the crop.

The use of fertilizer in the North is not recommended. In the Cotton Belt of the southeastern United States at least 200 pounds of superphosphate or 300 pounds of basic slag per acre should be used.

The Austrian Winter field pea is the most satisfactory variety for use as a winter cover crop in the South. In northern latitudes, where spring planting is practiced, a number of varieties may be used.

Cuttings for hay should not be made until the pods are well formed, and it is not well to harvest for grain until the pods are turning yellow, or later when the harvesting is done with a combine.

Pasturing with sheep and hogs is profitable in some regions.

When field peas are grown for hay, mixtures with oats or barley are recommended. In regions where the pea weevil is prevalent, seed should be fumigated promptly after being threshed.

This bulletin is a revision of and supersedes Farmers' Bulletin 690, The Field Pea as a Forage Crop

Washington, D. C. Issued June 1938

CULTURE AND PESTS OF FIELD PEAS

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INTRODUCTION

THE COMMON NAME "field pea" as used herein refers to varieties of peas (*Pisum arvense* L.) used for seed, forage, cover, and green manure. For the most part they are round, smooth seed which may be solid brown, yellow, bluish green, or mottled brown or gray. The plants are annual and have slender succulent stems 2 to 4 feet long, which ascend with support (fig. 1).

While the early colonists grew field peas in a limited way their extensive use was a much later development. At present they are grown for forage and seed more or less in New York, Michigan, Wisconsin, Minnesota, eastern North Dakota, and South Dakota, Montana, Idaho, Oregon, and Washington, and for a cover crop and green manure in the southeastern part of the Cotton Belt and in the Pacific Northwest.

CLIMATIC REQUIREMENTS

A cool growing season is necessary for the field pea, as high temperatures are much more injurious than frosts and are most disastrous when they occur when the pods are setting. These climatic requirements limit its successful production as a summer crop to the Northern States and Canada. It may, however, be grown as a winter crop in the Southern States (fig. 2). Its moisture requirements are less exacting than its temperature requirements, but, other things being equal, it does best where the rainfall is fairly abundant. A 15-inch rainfall in the northern Great Plains is suffi-

cient to produce a good crop, while 20 inches of rain in Kansas, Nebraska, or Colorado are inadequate.

When grown for hay or green manure, field peas are more tolerant of high temperatures than when grown for a seed crop. Profitable seed production is confined to northern latitudes or regions with comparatively cool weather.

FIGURE 1.—Fruiting branch of a field pea vine, showing the characteristics of stem and leaf and the succession of bloom and pods.

USES

Field peas are grown for hay, silage, pasture, green manure, and seed. When grown for hay, they are usually mixed with oats or some other small grain (fig. 3). These mixtures with grain stand up much better and make harvesting easier. The presence of rye, oats, or barley in the crop also causes it to cure more quickly. When grown for hay, the field pea works into a rotation very nicely, because it is removed from the field early in the year, thus allowing ample time for a thorough preparation of the soil during the fall. The feeding value of field pea hay is about the same as that of alfalfa.

Field peas make good silage when grown in mixture with a small grain and cut when the grain is nearly mature. Such silage has a high feeding value and has given excellent results when used for fattening cattle and sheep.

While field peas are not utilized as green manure or as a cover crop in some of the regions in which they are grown, thousands of acres are planted for these purposes in the Cotton Belt. As the field pea is a legume, it adds nitrogen to the soil as well as organic matter.

Because field peas should not be trampled, they are a success as a pasture plant only when planted with a small grain or when allowed to mature so that the entire plant may be utilized as pasturage. Their use in this latter manner is a common practice in parts of the Rocky Mountain States, where they usually are grazed by sheep.

COMMERCIAL VARIETIES IN THE UNITED STATES

The varieties used in any region depend upon adaptation and the object for which the crop is grown. In the Southern States, where fall planting is practiced, winter hardiness is essential, and the Austrian Winter variety is used almost exclusively. In Colorado,

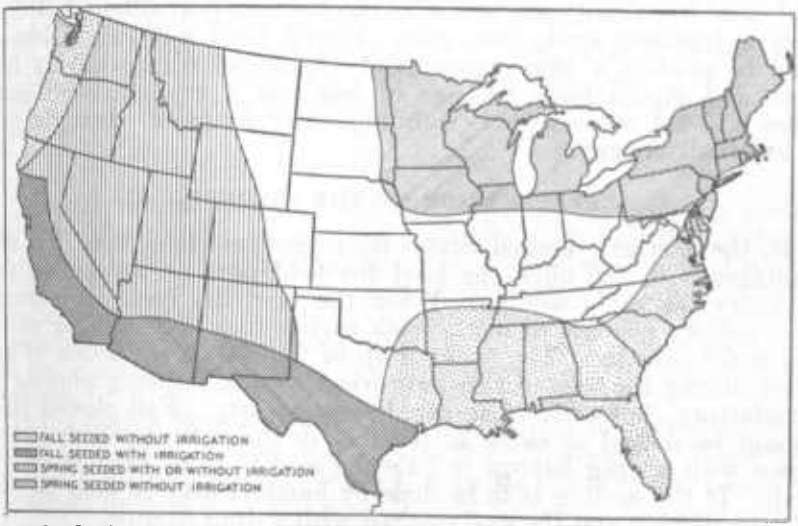

FIGURE 2.—Outline map of the United States, showing areas to which the field pea is well adapted.

the French Gray, Canadian Beauty, Clamart, and Agnes are all recommended for seed production, and Canadian Beauty and Agnes are recommended for pasture and hay. In the Great Lakes States, Canadian Beauty, Multipliers, Marrowfat, Scotch, Chang, and Chancellor varieties are recommended. In the Pacific Northwest the Austrian Winter, Bluebell, and Alaska are most commonly grown. Austrian Winter and French Gray have dark-colored seed, usually a gray ground overlain with purplish or brown dots or blotches.

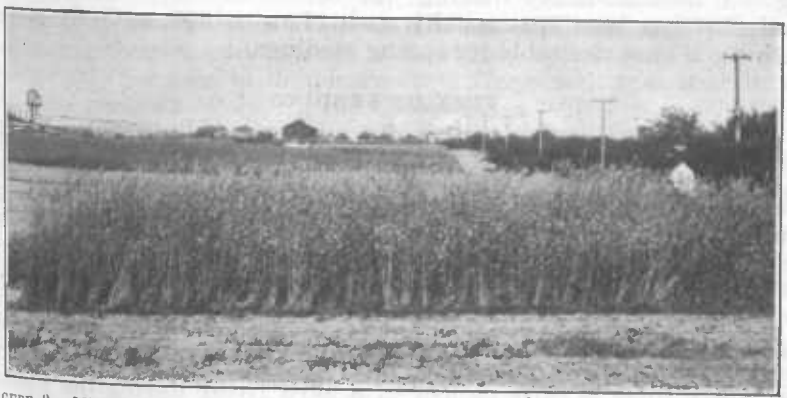

FIGURE 3.—Mixture of Austrian Winter field peas and rye on the Arlington Experiment Farm, Arlington, Va., near Washington, D. C., sown October 10, photographed June 14. The green-weight yield was 8.75 tons per acre.

Other varieties mentioned are lighter in color and for the most part are a cream yellow. The Austrian Winter matures later than the French Gray.

SOIL AND MOISTURE REQUIREMENTS

Well-drained clay loams of limestone origin or soils that are neutral or of low acidity are best suited to the field pea, although it does well on fertilized sandy loam soils. Heavy, black soils rich in humus tend to produce a heavy growth of vines with comparatively few pods and give a large tonnage of hay and a small yield of seed. They will not succeed where standing water occurs or where the soil is habitually boggy.

PREPARATION OF THE SEEDBED

In the northern United States most growers claim that it is advantageous to fall-plow the land for field peas on account of the necessity for early seeding. When the land has been fall-plowed, it is usually possible to sow a week earlier than when spring plowing is the practice. The opening up of the soil to the action of the frost during the winter also improves its tilth. Spring plowing is satisfactory, however, if it can be done early. Fall-plowed land should be disked as early as possible in the spring and smoothed down with a drag harrow in case the seed is to be planted with a drill. If the seeding is to be done by hand, it may be done following the disking and the seed covered with a drag harrow.

In the Southern States the largest acreage of winter legumes follows cotton, in which case little or no preparation of the soil is necessary. Other crops, such as tobacco, peanuts, cowpeas, soybeans, and melons, leave the soil in good condition, and but little preparation of a seedbed is essential following these crops. If for any reason the land needs plowing, the preparation is more expensive and requires more time. On clay soils where weed growth is abundant or where the soil is packed hard, plowing or heavy disking is essential.

In the Pacific Northwest the soil usually is quite compact where a fall-seeded crop has been grown, and will therefore require plowing. A medium-heavy disking just before seeding is sufficient for land that has been spring-cultivated. Late winter or early spring plowing is most desirable for spring seedings.

TIME OF SEEDING

In the North field peas must be planted early enough in the spring to set pods before the warm weather of summer arrives. The young plants are not harmed by light frosts, and even as far north as southern Canada and the northern part of Michigan, Wisconsin, and Minnesota the seed can be planted during the latter part of April and early May. In the intermountain sections of Colorado, Wyoming, Montana, Idaho, and the eastern parts of Oregon and Washington, from the first to the middle of April is the most favorable time. Throughout the Southern and Pacific Coast States in localities where there is little danger of a hard freeze during the winter, field peas should be seeded from September 15 to October 15.

In the northern part of the Cotton Belt, seeding should be done, if possible, during the last half of September, and in the southern part, early in October. Seedings made as late as the first of December will usually winter-kill severely or make but little growth by the time the crop should be turned down for corn or cotton.

In western Oregon and western Washington, fall seedings should be made from September 15 to November 1. Seedings after November 1 may be winter-killed.

In intermediate latitudes, where hard freezes may be expected during the winter, farmers sometimes sow field peas in February, thus giving them time to mature in May before the advent of hot weather.

RATE OF SEEDING

The size of the seed and the abundance of the rainfall govern the rate of seeding. In northern latitudes with abundant rainfall or irrigation, small-seeded varieties, such as Golden Vine or Austrian Winter, should be sown at the rate of 60 to 90 pounds to the acre; large-seeded varieties require nearly twice this amount. Under drier conditions, the quantity of seed should be decreased to 45 to 60 pounds for the small-seeded varieties and 80 to 100 pounds for larger-seeded varieties.

In the Cotton Belt, where the Austrian Winter is the variety commonly used, 40 pounds of seed an acre is recommended. When field peas are sown with grain in regions of ample rainfall, equal amounts by weight of field peas and grain should be used. In drier regions the amount of grain should be decreased. Mixtures with grain, however, are of doubtful value in regions of light rainfall.

METHOD OF SEEDING

The field pea is best sown with a grain drill, and if either a hoe drill or a disk drill is available it should be used in preference to broadcasting the seed by hand. In the South, where field peas are planted in cotton middles, the three-row one-horse drill is used. Usually the middle hole of the drill is closed, as the crop does not grow well in the center of the row, where the middle is low. In any drill care must be used to see that the feed in the drill does not crack the seed. Where a grain drill is not available, field peas may be sown broadcast and covered with a disk, spike-tooth harrow, or cultivator. Seeding in double rows is frequently practiced in the dry-land portions of the Pacific Coast States. This is accomplished most successfully by using an ordinary grain drill in which part of the holes or feeds have been closed. To allow for easy cultivation two open holes should alternate with four closed ones, so that each pair of rows will be 30 inches from the next pair.

Field peas should be planted 2 to 4 inches deep. In clay loam a depth of 2 inches is best, while in sandy soil a deeper covering is preferable.

When field peas are seeded with grain, the common practice is to mix them and sow them in one operation.

GERMINATION OF SEED

Seed more than 2 years old is liable to have low germination. Good seed of the current season's crop should germinate 90 percent or more, as field peas have little or no hard seed. In purchasing seed the grower should endeavor to obtain seed of the current season's crop that is accompanied by analysis tags showing the purity and germination of the seed. It is well to have the statements (tests) given on the tags confirmed by a reliable seed laboratory before the seed is planted.

FERTILIZERS

The use of fertilizers with field peas is not to be recommended in most regions of the northern United States. In the Cotton Belt of the Southeast the use of fertilizers is often essential. Of the common fertilizer constituents, phosphoric acid is usually the most needed. The fertilizer should be applied in the fall just prior to or at the time of seeding, in quantities varying with soil and cropping conditions. When the summer crop preceding the field peas is heavily fertilized, the peas will need little, if any, fertilizer. If the soil is poor and the summer application of fertilizer is light, the use of 200 to 400 pounds of superphosphate, or 300 to 600 of basic slag, and 50 pounds of sodium nitrate or ammonium sulphate or an equivalent nitrate fertilizer is advisable.

In the Pacific Northwest applying land plaster or gypsum at the rate of 50 to 100 pounds an acre in early March on fall-planted field peas and at the time of seeding on spring plantings increases yields on most soils. On soils high in fertility land plaster is not generally necessary.

INOCULATION

For best results, field peas must be inoculated. This is especially true in the more recently developed farming districts of the western United States and in the Cotton Belt of the Southeast, where the soils usually do not contain the necessary inoculating bacteria. Inoculation can be accomplished by the use of commercially available pure cultures, directions for which will be found on the package, or by the use of soil from a field that has recently grown field peas.

When soil is used, a small amount can be mixed with the seed at the time it is sown, or a larger amount can be applied broadcast and worked into the soil before the seed is sown. Many farmers in the South think it desirable to use both the commercial culture and soil.

The use of commercial fertilizer seems to favor inoculation and helps to insure nodule formation. The fertilizer, however, unless it is basic slag, should not come in contact with inoculated seed, as it may injure the inoculating organism.

Barnyard manure is effective in inducing inoculation, and its use, when available, is recommended.

WINTER-KILLING

None of the field pea varieties are hardy in the colder areas of the northern part of the United States. The most winter-hardy varieties, such as Grey Winter and Austrian Winter, are usually hardy as far north as Washington, D. C., in the East, and central Oklahoma in

the Great Plains. For this reason the Austrian Winter has become the popular variety for planting as a winter cover crop in the Southern States. Other varieties winter-kill regularly in any part of the Cotton Belt.

In western Oregon and western Washington, hardy varieties seldom suffer winter injury, and in many years medium-hardy varieties survive satisfactorily.

TURNING UNDER FOR GREEN MANURE

When used as a green manure to precede annual crops field peas should be turned under about 2 weeks before the planting of the annual crop. In the South, where field peas are used most largely for this purpose, earlier plowing is advised if the field peas have made sufficient growth. When the weight of green field peas is 14 pounds per 10- by 10-foot square, the nitrogen in the crop, calculated on an acre basis, is equivalent to about 300 pounds of nitrate of soda and is sufficient for a good crop of corn. To delay turning after this growth is attained in order to get 50 to 100 percent more nitrogen means running risks of dry weather, of unwieldy growth, of greater difficulties in getting stands of corn, and of possible injury from vetch worms. In their zeal to get the maximum quantity of nitrogen many farmers wait too long and run into unforeseen difficulties.

When the peas are at the stage of growth mentioned, they can be turned under with an ordinary two-horse plow with a 12-inch rolling colter attached.

If the growth is heavy, a thorough disking previous to plowing under will make the plowing easier. It also prevents a layer of coarse organic matter being deposited between the furrow slice and furrow bottom, which at times seriously retards the movement of soil moisture.

PASTURING FIELD PEAS

When field peas are planted for pasturage, either alone or with small grain, they give best results when allowed to mature before the animals are turned in, so the entire plant may be utilized. This is the common practice in parts of the Rocky Mountain States where such pastures are usually grazed by sheep. Animals pasturing on field peas should be confined by movable fences to one portion of the field at a time. If sheep or hogs are allowed to roam over the entire field, much of the crop is wasted. Lambs will fatten on field pea pasture in from 70 to 90 days, and a good crop will usually fatten from 10 to 15 lambs per acre, each animal gaining about 8 pounds a month. Hogs in a thrifty condition will fatten in from 60 to 90 days, and, if not obliged to gather their food over too large an acreage, will make an average daily gain of 1 pound, according to investigations at the Wyoming Agricultural Experiment Station.

More rapid gains may be made by hogs when a limited quantity of corn or barley and a supplementary protein of tankage, alfalfa meal, or skim milk are fed in addition to the peas. Access to a mineral mixture also should be provided.

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In the Pacific Northwest fall-sown field peas are often pastured in early spring, usually by sheep. Pasturing begins about March 15 and continues to April 20 or May 1. This reduces forage production, but many believe it increases seed setting and reduces harvesting costs because there is less material to be handled. Such pasturing should not be done when the land is so wet that puddling will result. Pasturing too late in a dry season may reduce yields of both forage and seed.

In pasturing hogs and sheep, it is well to remember that good results cannot be expected unless feed is abundant. The only way to assure continued substantial gains is to move the fattening animals to a new field as soon as peas become scarce and to use stock animals for cleaning up the field. Pasturing is a wasteful method of harvesting a crop, even under favorable conditions, and when the weather is adverse it not only prevents the animals from feeding properly, causing loss of flesh, but also adds heavily to the direct loss of the crop itself. A combination of pasture and dry feed gives the best results.

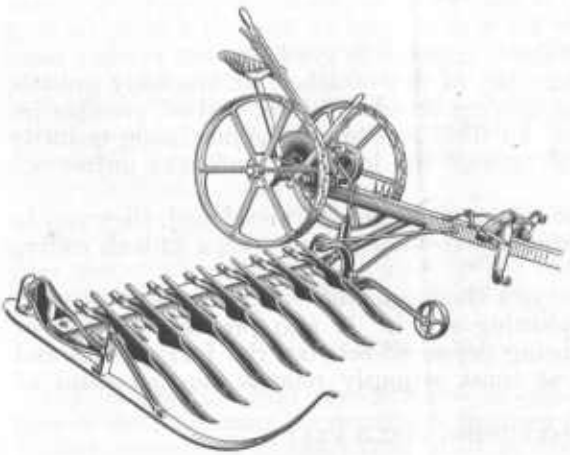

FIGURE 4.—A mower, showing an attachment designed to raise the field pea vines off the ground and allow the passage of the cutter bar beneath them.

HARVESTING FOR HAY

The proper time to cut field peas for hay is when most of the pods are well formed. When they have been seeded with grain, the time of cutting may be governed partly by the maturity of the grain, but the varieties of field peas and grain should be so chosen that the crop can be harvested at the most favorable period of maturity for both. Formerly, a crop of field peas was considered difficult to harvest, and much of the harvesting was done with a scythe or an old-fashioned cradle. There are now available for the ordinary mower attachments consisting of guards that extend in front of the cutter bar and lift the vines off the ground and a windrow attachment which effectively removes the vines from the swath and leaves them in a windrow behind the mower (figs. 4 and 5). The hay can be left in the windrow or bunched with a rake and left until dry and ready to stack or put into the mow.

Hay yields of field peas alone or in mixture with grain range from 1 to 3 tons per acre, depending on soil and other factors.

HARVESTING FOR SEED

The field pea should be cut for seed when the pods are mature and the seed is firm. It is not well, however, to wait until the vine

and pods are both dry, since if that is done the loss from shattering and weevil damage is sure to be large. Field peas are most commonly cut for seed with an ordinary mower equipped with a bunching attachment, but the windrow attachment previously described (p. 8 and fig. 5) is also used with good results. When the bunching attachment is used, a man with a pitchfork follows the mower and moves the bunches out of the path of the horses on the succeeding round. This method leaves field peas in a better condition to be hauled to the threshing machine or stack than when they are merely windrowed; it also prevents, to a large degree, the shattering which would accompany any use of a hay rake. When growth is heavy, the windrower is probably more satisfactory than the buncher. In a great many cases field peas are threshed directly from the bunches or windrows. If rain occurs while field peas are being cured, they should be turned as soon as the top of the bunch is dry. If this is neglected, considerable loss of seed by shattering will result.

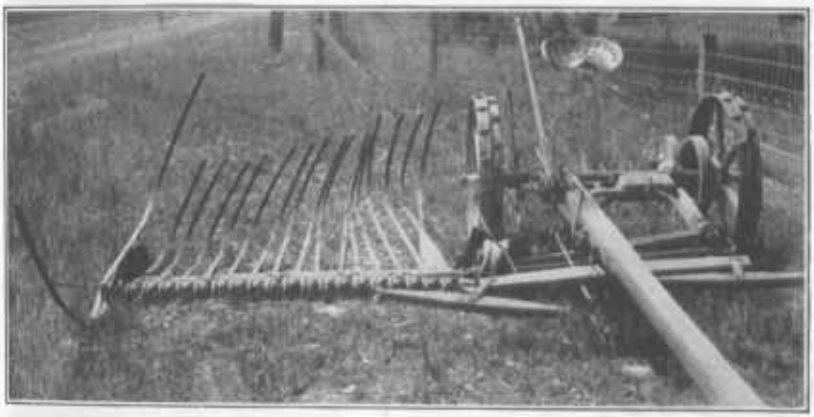

FIGURE 5.—A mower with a windrow attachment which automatically removes the material from the swath.

Yields as high as 2,000 pounds per acre or more are sometimes obtained, but an average yield is more nearly 1,000 pounds per acre.

THRESHING

The threshing of field peas is usually done with an ordinary grain separator (fig. 6) or combine fitted especially for the purpose by the substitution of blank concaves so that only one row of concave teeth is left below the cylinder. Usually four concave teeth are sufficient to retard the passage of the vines long enough for the cylinder to break the pods and release the seeds (fig. 7). By thus limiting the number of concave teeth and reducing the speed of the cylinder to about 600 revolutions per minute it is possible to thresh field peas without cracking any considerable percentage of the seeds. In regions of large field pea production, the threshing machine or combine is commonly equipped with an adjustable wooden pulley which makes it possible to decrease the speed of the cylinder to the required number of revolutions. Where the field peas are intended wholly for livestock feeding such precautions are not necessary since cracked

seed is then not objectionable, but there may be some waste by loss of small portions of the seeds. Where the crop is to be sold for seed purposes, great care should be used in threshing, as cracked, chipped, or partly hulled seed is less viable and has low market value. A small pea huller, of which there are several kinds on the

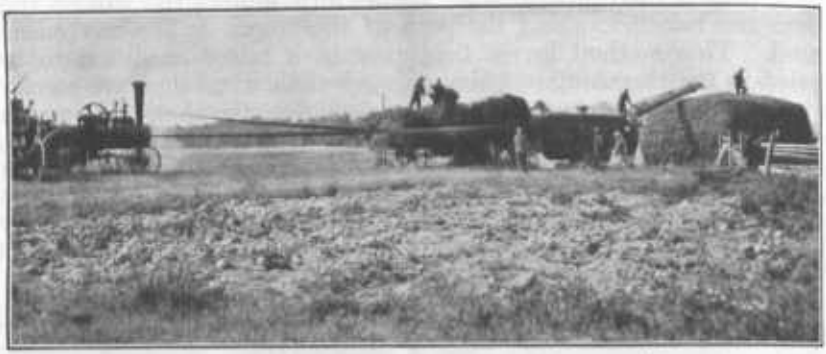

FIGURE 6.—Threshing field peas with an ordinary steam threshing outfit equipped with a self-feeder.

market, is well adapted to the uses of the farmer who is growing only a small acreage and expects to sell his threshed crop to a seed dealer. Where a machine of this kind or a grain thresher or combine is not available, the farmer can thresh seed for his own use with a flail or by treading out the seed with horses, as shown in figure 8. After the seed is flailed or tramped out, considerable work is required to separate the seed from the trash, so that this becomes in the end a rather expensive method of threshing. Combines are now in rather common use for threshing field peas. The field peas are picked up, and attachments are used in handling the crop from the swaths or windrows.

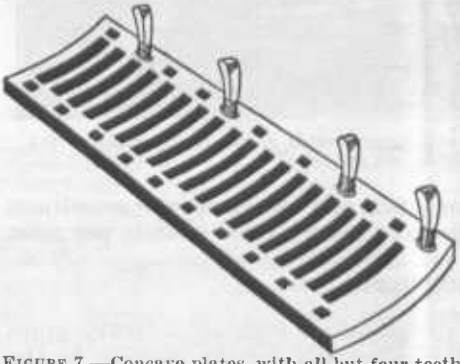

FIGURE 7.—Concave plates, with all but four teeth removed, adjusted for threshing field peas.

PREPARATION OF SEED FOR MARKET

Field peas for market should be reasonably true to variety and should be cleaned so as to comply with one of the grades in the official United States standards. Copies of these standards may be obtained from the Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C.

Cleaning may be done with a number of mechanical cleaners, of which there are several on the market. These cleaners can be adjusted not only to satisfactorily clean but also to grade the seeds to size. For convenience in handling, the seed is usually put in 100-pound strong burlap bags.

Fumigation is necessary in regions where the pea weevil is a factor. The fumigating should be done immediately after threshing for best results (p. 14).

Seed should be stored under dry, well-ventilated, rodent-free conditions.

SOURCE OF SEED

Although field pea seed can be produced throughout the northern United States wherever there is ample rainfall, most of the acreage planted for this purpose is in Oregon, Washington, and Idaho. In recent years the increased use of the Austrian Winter variety for a cover crop in the South, where seed production has not proved practical, has resulted in greatly increased acreage in the Pacific Northwest, where conditions are especially favorable for seed production.

FIGURE 8.—Treading out field peas with horses and a concrete roller. Few peas are cracked by this method of threshing.

Some seed of the Austrian Winter variety is imported from south-central Europe. Seed of the Partridge variety is occasionally imported from New Zealand. Seed of other varieties in small quantities is sometimes brought in but is unimportant. Judging from limited experimental results, there seems to be no difference between imported and domestic-grown seed, nor has any difference been noted between seed produced from spring and fall seedings.

ROTATIONS

The value of field peas in rotations with hay, grain, and corn has been proved throughout the Northern States and also in a few localities in the mountain districts and irrigated valleys of the West. In the Northeastern and North Central States, where rotations are regularly practiced, field peas usually follow a meadow crop. Field peas have been found very effective in furthering the disintegration of the sod, and this fact has determined their position in the rotation.

The substitution of field peas for summer fallow in the wheat rotations of the Pacific Northwest is being practiced by some growers. A crop of field peas leaves the ground in practically as good a condition for wheat as fallow, and gives equally good yields. Also smut in the wheat is less noticeable where wheat follows field peas. At the Sherman County Branch Experiment Station, Moro, Oreg., the average yield of four plots of spring wheat after field peas for 4 years was 40.2 bushels an acre, while the average yield of two adjacent plots of wheat after summer fallow during the same period was 38.5 bushels to the acre.

DISEASES[1]

LEAF SPOT AND STEM BLIGHT

Leaf spot and stem blight (*Ascochyta pisi* Lib., *Mycosphaerella pinodes* (Berk. and Blox.) Stone, and *Ascochyta pinodella* Jones) are fungus diseases which occur in most pea-growing sections and may become destructive in the more humid areas. They are characterized by brown to black spots of varying sizes and shapes on all above-ground parts of the plant. A characteristic blackening of the stem, often extending from a short distance below the soil surface to several inches up the stem, is common in some localities. Many stems may be girdled and killed. Disease-free seed should be sown and rotation practiced. Satisfactory control will probably not be possible until resistant varieties or selections are available.

BACTERIAL BLIGHT

Bacterial blight of peas, caused by *Phytomonas pisi* (Sack.) Bergey et al., attacks all above-ground parts of the plant, producing olive-green to olive-brown, water-soaked areas. The entire infected plant may be killed. No really satisfactory control measures are known, but where practical, only clean seed should be sown, and rotation should be practiced.

LEAF BLOTCH

The fungus *Septoria pisi* West. causing leaf blotch, kills areas of the leaf, and may run into the petioles and stems. Usually the spots appear at the margin of the leaf as yellowish areas which gradually darken and enlarge. The entire leaf and petiole may be killed and brownish dead areas may be produced on the stems. Occasionally a field of peas may be injured severely, but generally the disease is not important. Rotation should help to hold it in check.

POWDERY MILDEW

Powdery mildew is a disease caused by the fungus *Erysiphe polygoni* DC. and is characterized by a white coating on the leaves, stems, and pods. Usually it is most destructive on late-planted or late-maturing varieties of field peas. Rotation and clean cultivation are desirable when practical. Where only small portions of a field are affected, the spread of the disease can be retarded by dusting with a mixture of 4 parts of sulphur to 6 parts of hydrated lime. The

[1] A more detailed discussion of these diseases will be found in Farmers' Bulletin 1735, Pea Diseases and their Control.

number of applications necessary varies with conditions. If large areas are affected it is not economical to dust.

DOWNY MILDEW

Downy mildew, caused by *Peronospora viciae* (Berk.) DBy., is widespread but seldom very destructive except in certain humid areas. The fungus causes localized light-green spots often blotched with brown on the upper surfaces of the leaves. In the later stages of the disease the affected areas die and turn brown. On the lower surface of the leaf the affected spots are covered with a whitish moldy appearing growth. The disease is carried in the seed and lives in the soil for an indefinite period. Rotation should be practiced, and, if practical, seed should be obtained from semiarid regions.

ANTHRACNOSE

The fungus *Colletotrichum pisi* Pat. which causes anthracnose attacks all above-ground parts of the plant. On the leaves the spots are irregular in outline and brownish in color, with somewhat darker borders. The affected areas on the pods are circular and sunken, and on the stems they are elongate. Anthracnose is seldom of much importance, and no control measures have been worked out. Crop rotation should be helpful.

FUSARIUM WILT

Fusarium wilt, caused by the fungus *Fusarium orthoceras* Appel and Wr. var. *pisi* Linford, is characterized by a rapid wilting of the vines without conspicuous rotting of the roots. Rotation of peas with other crops is recommended.

ROOT ROTS

The term "root rots" is applied to a number of diseases caused by different fungi, all of which attack the underground parts of the plant, causing more or less decay. The decayed tissue may be reddish, gray, brown, or black. As a result of the death of the roots the tops are stunted and often yellowish, and the plant may die. Rotation is recommended as a good practice, but it will be only partly successful as a control measure since some of the root rot fungi attack other crops as well as peas.

MOSAIC

Field peas, as well as other legumes, are affected by mosaic disease. The presence of these diseases is recognized by the intermixing of light- and dark-green areas in the leaves. The mottled areas are irregular in outline and may follow the small veinlets. No control is known.

INSECT ENEMIES

PEA WEEVIL

The pea weevil (*Bruchus pisorum* L.)[2] is the most serious insect enemy of the field pea, and has done more than anything else to limit

[2] Described in U. S. Department of Agriculture Yearbook for 1898, pp. 233–260.

the acreage of the crop. It is a small grayish or brownish-gray beetle, marked with lighter spots. The insect lays its egg on the young pod; the egg hatches and produces a larva which bores through the wall of the pod and enters the young seed, where it feeds on the growing embryo and later pupates. The pupa may remain in the seed until the next season, emerging the following spring, but many of them come out soon after harvest, so that the dates of emergence will range from harvest to planting time the following year.

The most effective method for preventing damage to the seed harvested is to fumigate with carbon disulphide as soon as the seed is threshed. Carbon disulphide can be obtained at a reasonable cost from any druggist. The seed must be placed in a tight container and exposed from 30 to 48 hours to the fumes of this liquid. The carbon disulphide should be exposed in a shallow dish placed on top of the seed, since the vapor is heavier than air. *This vapor when mixed with air is inflammable, and, to avoid a serious explosion, care should be taken not to ignite it in any way.* One pound of the liquid is usually sufficient to fumigate 100 bushels of seed, but it is well to use somewhat more than this in order to kill all of the insects. Chloropicrin and hydrocyanic acid gases are occasionally used as fumigants. Prompt fumigation after threshing is essential.

Continuous cropping to the field pea is almost sure to mean a constant increase of the pea weevil. Practically the only remedy is to stop growing field peas for several years. Control measures such as burning the stubble and destroying shattered seed before weevils emerge will help materially. More detailed information can be obtained from State experiment stations or from the Bureau of Entomology and Plant Quarantine, Department of Agriculture, Washington, D. C.

PEA APHID

The pea aphid or plant louse (*Illinoia pisi* Kalt.) is another insect which occasionally does considerable damage. It has appeared in field pea sections at intervals and practically destroyed the season's crop, but it does not stay with the crop so continuously year after year as does the weevil. The aphid increases rapidly during a period of warm, dry weather, but a heavy rain, even when the insect is abundant, will sometimes free the vines almost entirely from it. Parasites and predators, under favorable weather conditions, often hold the infestations of this pest in check. Dusting with an insecticide has in some instances been found practical with canning peas, but the returns from field peas hardly justify the expense. Information regarding such practice can be obtained from State experiment stations or the Bureau of Entomology and Plant Quarantine, Department of Agriculture.

PEA MOTH

The pea moth (*Laspeyresia nigricana* Steph.) is found in the Great Lakes region and the Pacific Northwest.[3] The moth appears soon after the field pea vines begin to bloom, usually about July 14, and lays its eggs on the pods, leaves, and stems. The eggs hatch in

[3] For further information see Wisconsin Agricultural Experiment Station Bulletin 130, The Pea Moth: How To Control It, and Washington Agricultural Experiment Station Bulletin 327, The Pea Moth.

7 to 10 days and the larvae enter the pods and feed on the seeds. Growth is completed in from 16 to 26 days, then they emerge from the pods and pass the winter in the soil.

The most effective remedy is to grow early varieties, seed early, thresh early, and then burn the rubbish left on the field, or plow it under deeply, preferably in the fall. Whenever possible, new crops should be planted at a distance of at least 2 miles from fields that were known to be infested during the previous season.

NEMATODE INJURY

The field pea is subject to attack by a nematode which causes the so-called root knot on the roots. Most damage is done during comparatively warm weather and under such conditions serious damage may be done. In the Southern States where damage is most likely and where field peas are used for green manure, this can be avoided by late planting in the fall and turning under comparatively early in the spring. Rotation with nonsusceptible crops and growing the crop only during the coolest part of the year will help control this pest.

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U. S. GOVERNMENT PRINTING OFFICE: 1938

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